Norovirus Infection (Formerly Known as Norwalk Virus)

Single norovirus infections are treated symptomatically and are not reportable to the state. Outbreaks are reportable to the state.

Noroviral infection, extremely common and rarely diagnosed, is a viral infection that causes acute gastroenteritis. These viruses were previously referred to as Norwalk-like viruses. They are small, round, structured viruses that belong in the family *Caliciviridae*.

Noroviruses are very contagious. An inoculum of as few as ten viral particles may cause infection. The viruses are transmitted primarily through fecal-oral transmission, through consumption of fecally-contaminated food or water, by direct person-to-person spread, or by contact with contaminated objects. Outbreaks have been described where the initial mode of transmission was foodborne, followed by person-to-person transmission. Evidence exists showing transmission can occur from the aerosolization of vomitus, resulting in contamination of surfaces or viral entry through oral mucosa.

Norovirus infection usually presents as acute onset vomiting, watery diarrhea (non-bloody) with abdominal cramps and nausea; however, asymptomatic infections may occur in as many as 30% of those infected. Viral shedding begins with the onset of symptoms and potentially persists up to two weeks. It is unclear if viral shedding over 72 hours post recovery signifies continued infectivity.

There are approximately 4,500,000 episodes of diarrhea in Louisiana yearly, leading to 10,000 hospitalizations and 50 deaths. (Extrapolation to Louisiana based on Mounts AW 1999. *Trends in hospitalizations associated with gastroenteritis among adults in the USA*, 1979-1995. Epidemiology & Infection 123: 3-8). An etiologic agent can be identified in less than 10% of these cases. Estimation of the number of norovirus cases is 400,000 cases per year in Louisiana, one-third of these being foodborne. Of the norovirus outbreaks in Louisiana between 2000 and 2017, 63% were person-to-person outbreaks and 23% were solely foodborne, the remainder were either unknown modes of transmission or a combination (Table). Difficulty arises in determining if an outbreak is considered foodborne or person-to-person in a setting where food is served but no food item is significantly associated with illness.

Outbreaks of norovirus are usually characterized by high attack rates in all ages. This phenomenon may be explained by strain-specific immunity of only a few months duration. Recent evidence also suggests that susceptibility to infections may be genetically determined, with people of the O blood group being at greatest risk for severe infection.

According to the Centers for Disease Control and Prevention (CDC), Norovirus was the most common cause of outbreaks with one identified etiology, accounting for 164 outbreaks, which was 37% of the national total (*Surveillance for Foodborne Disease Outbreaks, United States, 2017, Annual Report.* Atlanta, Georgia: U.S. Department of Health and Human Services, CDC, 2017).

Foodborne outbreaks of norovirus can arise through direct contamination of food by a food handler immediately preceding its consumption. Outbreaks are commonly associated with consumption of cold foods including salads, sandwiches and bakery products. Liquid foods such as salad dressings and cake icings have also been implicated. Foods can be contaminated at their source or prior to distribution, with examples being oysters from contaminated waters, or raspberries and salads processed prior to widespread distribution. The table shows that oysters contaminated at their source were the most likely foods implicated in several norovirus outbreaks in Louisiana. Waterborne outbreaks are frequently caused by sewage contamination of wells and recreational waters.

Diagnosis of Norovirus

Since the discovery of viral gastro-enteritis outbreaks in the 1970s, laboratory confirmation of this etiology has continued to develop. Molecular assays such as Reverse Transcription Polymerase Chain Reaction (RT-PCR) have now made the etiologic diagnosis much easier to obtain.

Identification of the virus is best made from stool specimens taken within 48 to 72 hours after symptom onset, although diagnosis is possible on stool taken as long as five to 14 days post onset. Assays for identification of norovirus in foods are not helpful on a consistent basis and are generally not used, although assays to detect the virus in shellfish are routinely utilized.

The criteria for a presumptive diagnosis of viral gastroenteritis outbreaks are:

- mean (or median) illness duration of 12 to 60 hours
- mean (or median) incubation period of 24 to 48 hours
- greater than 50% of the cases with vomiting
- no bacterial agent previously found.

The table illustrates that the mean incubation period in outbreaks in Louisiana where norovirus was the only suspected etiology was 29 hours. Mean duration of illness was 39 hours.

Table: Summary of outbreak investigations – Norovirus – Louisiana, 2000-2018

Location	Month	Year	Number Ill	Number Investigated	Attack Rate	Case Type	Samples Tested	% Positive	Symptoms	Mean Incubation	Duration (Hrs)	Transmission	Parish	Source
N	05	2000	55	178	31	H, R	5	100	NVD	-	-	PP	E. Feliciana	-
R	01	2001	13	46	28	P	0	-	NDF	27	22	FB	Orleans	OY
V	06	2001	75	269	28	W, P	4	25	VDC	26	24	FB, PP	Orleans	-
R	03	2002	26	61	43	P	9	67	NDC	23	37	FB	Orleans	OY
P	12	2002	20	30	67	P	4	25	NDC	8	90	FB	OOS	OY
V	04	2003	13	53	25	W, P	3	100	NVD	-	21	FB	Orleans	-
R	10	2003	15	22	68	P	3	100	NDC	37	44	FB	St. Bernard	-
P	01	2004	11	17	65	P	2	50	NVD	37	51	FB	OOS	-
R	03	2004	26	35	74	P	7	100	NVC	37	38	-	Lafayette	-
S	10	2004	59	113	52	P	8	0	VD	-	36	FB, PP	Calcasieu	M
R	12	2004	12	18	67	P	0	-	NVD	33	24	FB	Ouachita	-
N	04	2005	79	240	33	H, R	3	100	NDC	-	48	PP	Orleans	-
R	05	2005	65	1380	5	P, W	3	33	NVC	20	35	FB, PP	Jefferson	-
N	05	2006	19	19	15	R	5	100	NV	-	-	PP	Lafayette	-
N	07	2006	53	53	47	R, W	3	100	NV	-	-	PP	Concordia	-
N	07	2006	15	15	-	R	4	25	NVD	-	-	PP	Franklin	-
N	02	2007	41	102	40	R	19	37	NV	-	36	PP	Orleans	-
O	02	2007	-	-	25	R	-	-	D	-	-	PP	Baton Rouge	-
S	03	2007	332	-	-	P	-	-	NVD	-	60	PP	P. Coupee	-
N	03	2007	37	-	-	R	7	14	NVD	-	-	PP	E. Feliciana	-
N	11	2007	80	196	41	R, H	-	-	NVD	-	24	PP	Orleans	-
N	02	2008	39	88	44	R, H	3	67	VD	-	24	PP	Lafourche	-
O	03	2008	12	21	57	P, W	4	75	VD	35.3	-	PP	Iberia	-
R	09	2008	7	8	88	H	1	100	NVD	9	-	FB	Orleans	U
O	09	2008	22	66	33	R	2	100	NVD	-	-	PP	Terrebonne	-
N	12	2008	23	43	53	R, H,W	1	100	VD	-	-	PP	St. Tammany	-
N	12	2008	43	203	21	R, W	3	67	NVD	-	60	PP	St. Tammany	-
R	1	2009	19	-	-	P	1	100	NVD	27	36	FB	Rapides	U
R	1	2009	14	-	-	P	1	100	NVD	27	-	PP	Rapides	-
O	3	2009	18	42	43	W	5	40	VD	-	-	FB, PP	St. Bernard	U
N	4	2009	34			R,W	4	25	D	-	-	PP	Concordia	-

Location	Month	Year	Number Ill	Number Investigated	Attack Rate	Case Type	Samples Tested	% Positive	Symptoms	Mean Incubation	Duration (Hrs)	Transmission	Parish	Source
N	12	2009	29	-	-	R	0	-	VD	-	-	FB	Orleans	U
N	2	2010	37	54	68.5	R,W	2	50	NVD	-	-	PP	Jefferson	-
N	2	2010	17	-	-	R,W	12	58	NVDC	-	36	PP	Calcasieu	-
N	2	2010	17	-	-	R,W	5	80	NVD	-	48	PP	Orleans	-
O	2	2010	10	-	-	R,W	0		VD	-	-	PP	Jefferson	-
N	3	2010	68	190	35.8	R	4	100	NVDC	-	-	PP	E. Baton Rouge	-
N	3	2010	40	250	16	R,W	2	50	NVDC	-	-	PP	Jefferson	-
N	3	2010	13	-	-	R,W	3	33	NVDC	-	72	PP	E. Baton Rouge	-
O	3	2010	91	-	-	W	2	100	NVDC	-	120	PP	E. Baton Rouge	-
R	3	2010	14	15	93.3	P	1	100	NVDC	25	17	FB	Orleans	OY
N	3	2010	25	-	-	R,W	0	-	NVDC	-	-	PP	Terrebonne	-
R	3	2010	19	47	40.4	P	3	100	NVDC	30	18	FB	Orleans	OY
R	3	2010	9	13	69.2	P	0	-	NVDC	27	57	FB	Orleans	OY
N	3	2010	104	280	37.1	R,W	7	86	NVDC	-	72	PP	Jefferson Davis	-
N	4	2010	44	-	-	R,W	2	50	NVDC	-	-	PP	St. Tammany	-
R	6	2010	10	18	55.6	P	3	100	NVDC	34	34	FB, PP	Ascension	U
S	11	2010	16	-	-	P	1	100	NV	-	-	FB, PP	E. Baton Rouge	U
R	12	2010	12	19	63.2	P	2	100	NV	31	49	FB, PP	Orleans	U
R	2	2011	6	-	-	P	2	100	NVD	-	45	FB	Multiple	OOS
N	2	2011	14	-	-	R, H	1	100	NVD	-	48	PP	Jefferson	-
N	2	2011	27	-	-	R, H	3	100	NVD	-		PP	Rapides	-
O	8	2011	28	-	-	P	3	100	NVD	38	24	EC	Washington	-
O	9	2011	15	42	36	W	3	100	NVD	42	36	FB	Rapides	O
N	11	2011	43	-	-	R	3	67	NVD	-		PP	St. Tammany	-
N	12	2011	54	174	31	R, H	6	67	NVD	-	72	PP	Ouachita	-
N	12	2011	78	-	-	R, H	5	100	NVD	-		PP	Ouachita	-
S	12	2011	22	85	26	P	5	60	NVD	-	36	PP	Lafayette	-
O	12	2011	30	49	61	R, H	14	86	NVD	-	43	PP	Calcasieu	-
N	1	2012	34	96	35	R, H	2	100	NVD	-		PP	Jefferson	-
O	2	2012	5	29	17	R, H	2	100	NVD	-	48	PP	Lafayette	-
R	5	2012	14	54	26	P	1	100	NVD	41	31	FB	Orleans	OY

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R	10	2012	27	-	-	P	1	100	NVD	-	22	FB	Orleans	U
N	12	2012	40	100	40	R, H	3	67	NVD	-		PP	Caddo	-
O	12	2012	12	13	92	P	1	100	NVD	23	29	FB	Iberia	OY
R	2	2013	7	13	54	P	2	100	NVD	30	36	FB	Livingston	U
N	3	2013	50	86	58	R, H	4	25	NVD	-		PP	Orleans	-
O	4	2013	53	161	33	R	8	100	NVD	-	51	PP	E. Feliciana	-
O	4	2013	11	22	50	R	3	100	NVD	-		PP	Rapides	-
O	4	2013	3	-	-	P	1	100	NVD	-		U	Multiple	-
R	5	2013	15	33	45	P	6	100	NVD	38	52	FB	St. Tammany	O
R	5	2013	40	71	56	P	8	88	NVD	37	36	FB	St. Tammany	O
R	8	2013	6	7	86	P	3	100	NVD	-	29	FB	St. Bernard	O
N	9	2013	20	136	-	R, H	0		NVD	-		PP	St. Tammany	-
O	12	2013	9	-	-	R, H	3	100	NVD	-	24	FB	Rapides	U
R	1	2014	6	7	86	P	3	100	NVD	35	14	FB	E. Baton Rouge	OY
O	1	2014	11	29	38	R, H	3	33	NVD	-	-	PP	Rapides	-
O	2	2014	20	-	-	P, W	3	67	NVD	-	-	PP	Allen	-
N	2	2014	33	101	33	R	5	80	NVD	-	10	PP	Acadia	-
O	2	2014	35	-	-	R	5	60	NVD	-	-	PP	E. Feliciana	-
O	3	2014	6	-	-	P	3	100	NVD	-	36	U	Lincoln	U
O	3	2014	33	177	19	R, H	2	100	NVD	-	24	PP	E. Baton Rouge	-
N	3	2014	75	254	30	R, H	7	43	NVD	-	24	PP	Ouachita	-
N	4	2014	49	86	57	R, H	2	50	NVD	-	-	PP	St. Charles	-
N	6	2014	20	43	47	R	3	100	NVD	-	24	PP	Rapides	-
S	10	2014	61	380	16	P	1	100	NVD	-	-	PP	Jefferson	-
O	11	2014	8	528	1.5	P, W	1	100	NVD	-	41	PP	Orleans	-
N	1	2015	40	170	23.5	R, H	0	N/A	NVD	-	-	PP	Caddo	-
N	2	2015	46	96	47.9	R	2	100	NVD	-	-	PP	E. Baton Rouge	-
N	2	2015	37	235	15.7	R, H	5	100	NVD	-	72	PP	Terrebonne	-
N	3	2015	23	48	47.9	R, H	1	100	NVD	-	48	PP	Lincoln	-
R	5	2015	21	48	43.8	P	2	100	NVD	35	24	U	Tangipahoa	U
O	6	2015	6	-	-	P	2	100	NVD	28.8	32	U	Calcasieu	U

Location	Month	Year	Number Ill	Number Investigated	Attack Rate	Case Type	Samples Tested	% Positive	Symptoms	Mean Incubation	Duration (Hrs)	Transmission	Parish	Source
S	11	2015	87	700	12.4	P	7	42.9	NVD	-	52	U	Red River	U
S	1	2016	9	16	56.3	W	8	100	NVDC	29	33	FB	Orleans	U
N	02	2016	17	122	13.9	R, H	2	100	NVDC	-	-	U	E. Baton Rouge	U
N	04	2016	69	290	23.8	R, H	2	50	NVDC	-	24	PP	St. Tammany	U
R	07	2016	6	-	-	P	3	100	NVDC	15	48	FB	Jefferson	U
O	11	2016	28	120	23.3	R, H	4	100	NVDC	-	23	PP	Rapides	U
O	11	2016	17	41	41.5	R, H	5	100	NVDC	-	24	PP	Rapides	U
O	11	2016	8	-	-	R	9	88.9	NVDC	-	36	PP	E. Baton Rouge	U
N	11	2016	33	110	30.0	R, H	2	100	NVDC	-	48	PP	Lafayette	U
N	12	2016	50	276	18.1	R, H	8	25	NVDC	-	24	PP	E. Baton Rouge	U
R	12	2016	46	100	46.0	W, P	6	100	NVDC	29	36	FB	Lafayette	O
N	1	2017	51	146	34.9	R, H	3	100	NVD	-	28	PP	Calcasieu	U
S	3	2017	326	1108	29.4	G, W	7	57.1	NVDC	-	-	PP	Tangipahoa	U
R	4	2017	7	8	87.5	G	1	100	NVD	-	-	FB	Rapides	U
N	11	2017	41	78	52.6	R, H	5	100	NVD	-	-	PP	St. Mary	U
N	12	2017	35	-	-	R	7	1	NVD	-	-	PP	E. Baton Rouge	U
N	1	2018	79	-	-	R, H	7	57	D	-	24	PP	Lafourche	U
N	1	2018	39	171	22.8	R, H	5	60	NVD	-	-	PP	Lafourche	U
N	1	2018	62	173	35.8	R, H	6	33	NVD	-	48	PP	Terrebonne	U
N	2	2018	20	263	7.6	R, H	1	100	NVD	-	-	PP	East Feliciana	U
S	4	2018	46	913	5.0	P	2	100	NVD	-	-	PP	E. Baton Rouge	U
N	2	2018	14	166	8.4	R, H	5	100	NVD	-	84	PP	Jefferson Davis	U
O	9	2018	7	-	-	P	5	100	NVDC	-	-	PP	Orleans	U
N	3	2018	53	157	33.8	R, H	6	83	DV	-	-	PP	Terrebonne	U
N	2	2018	69	-	-	R, H	7	71	NVD	-	-	PP	St. Tammany	U
N	12	2018	6	-	-	R, H	3	33	NVD	-	-	PP	Lafayette	U
N	12	2018	38	-	-	R, H	1	100	NVD	-	-	PP	Lafayette	U
O	5	2018	61	-	-	P	2	100	NVD	-	-	FB	St. Tammany	U
S	10	2018	13	-	-	P	1	100	NVD	-	-	PP	Livingston	U
N	1	2018	64	-	-	R, H	1	100	NVDC	-	24	PP	Bossier	U

Location: N=nursing home; R=Restaurant/Caterer; V=Vessel; P=Picnic; S=School, O=Other
Case type: H=Health care worker; R=Resident/patient; P=General public; W=worker/employee
Symptoms: D=Diarrhea; N=Nausea; V=Vomiting; F=Fever; C=Cramps
Transmission: PP=Person-to-person; FB=Foodborne; EC Environmental contact
Source: OY=Oysters from bed; OZ=Oyster post-harvest contamination; F=Fruit; M=Meat; U=Undetermined; OOS=Out-of-State; O= Other

Prevention of Norovirus

Noroviruses are relatively resistant to environmental challenges. These viruses survive freezing, are heat stable at temperatures up to 60°C and when in water, can survive chlorine levels above those found in public water systems. Despite the environmental resistance, simple measures, including; proper handling of food (especially cold items); frequent hand-washing; and paid sick leave for food service employees, may substantially limit transmission of norovirus.

Seasonality of Norovirus

While norovirus can be spread at any time of the year, outbreaks and infections occur more commonly in winter months. Worldwide, about half of all cases occur in the three coldest months of the year (December – February in the Northern Hemisphere, June – August in the Southern Hemisphere) (*Norovirus Worldwide,* CDC, 2016). As norovirus infection is not a reportable condition in Louisiana, only outbreaks are recorded and not each individual case. In Louisiana, 45% of outbreaks occur between February and April, with February having the peak percentage at 17% (Figure).

Figure: Percentage of Norovirus Outbreaks by Month, 1989-2018